MODULE CAM AND METHOD FOR ALIGNING AND FASTENING TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a module cam assembly and a method for aligning and fastening a tool to the module cam assembly. The module cam assembly is detachably sandwiched between the upper and lower die holders of a press machine.

2. Related Art

Referring to Fig.6, when it is desired to bend and punch work pieces using a variety of metal molds (dies) having upper half and lower half, a cam unit is known as installed between the upper and lower die holders of a press machine. The cam unit comprises a vertically movable cam driver 22 fixed to an upper die holder 21, a horizontally movable cam slider 23 slidably connected to the cam driver 22, a positive return 24 having a resilient member responsive to the rise of the cam driver 22 for driving the cam slider 23 to the original position, and a lower die holder 25 slidably supporting the cam slider 23. The cam driver 22 has a downward cam slope, and the cam slider 23 has an upward cam slope. The cam driver 22 and the cam slider 23 are combined together with their slopes put in contact each other, so that the rise and descend of the cam driver 22 may move the cam slider 23 back and forth. The cam slider 23 is biased toward its original position in which the cam dive 22 is raised to its upper dead point, and the cam slider 23 is responsive to the rise of the cam driver 22 for moving back to the original position.

The cam slider 23 has, for example, a punch 26 fastened to its vertical side for piercing the work pieces, whereas the lower holder 25 has a die 27 fastened to its vertical side corresponding to the punch 26. Such tool parts are aligned with each other to assure side piercing or side cutting of work pieces.

The above dies (cam unit) are massive and heavy and accordingly the cam driver, the cam slider and the cam base, a part of the lower die, are combined as a cam unit in order to improve its adaptability to a variety of machining to work pieces. For example, it is known such a compact cam unit 28 being narrow in width as

shown in Figs.7A and 7B, which comprises a cam driver 28a, a cam slider 28b, a cam base 28c, and a positive return 28d. The cam unit 28 is of "horizontal" (die-mounted) type. As shown in Figs.8A and 8B, another cam unit 29 comprises a cam driver 29a, a cam slider 29b, and a cam base 29c, which the above cam unit 28 is turned upside down. The cam slider 29b is equipped with a positive return 29d. The so assembled cam unit 29 is of "flying" (aerial) type.

Such a cam unit, however, is useless in reducing the difficulty in aligning and fastening a tool such as the punch 26 and die 27 in exact position. The cam unit is fixedly set on the lower die holder 25, and the upper die holder 21 is raised or lowered slowly and by degrees to control the horizontal movement of the cam slider 23 until the die 27 and the punch 26 are put exactly in alignment. When aligned, the punch 26 and die 27 are tentatively fixed to the stationary and movable parts of the press machine. Then, the upper die holder 21 is raised up to the upper dead point, and the punch 26 and die 27 are fixed in position. The upper holder 21 is lowered to the lower dead point to check if the punch 26 and die 27 are aligned with each other. Usually this centering sequence is repeated until these tool parts are put exactly in alignment. JP2002-143944 (A) proposes use of a key in aligning tool parts.

As mentioned above, the aligning-and-setting work is very tedious, requiring the rise and descend of the upper die holder for putting tool parts exactly in alignment.

One object of the present invention is to provide a module cam assembly facilitating the aligning and setting of tool parts.

Another object of the present invention is to provide a method of aligning and attaching tool parts to the stationary and movable parts of a press machine.

SUMMARY OF THE INVENTION

To attain these objects a module cam assembly to be sandwiched between upper and lower die holders of a pressing apparatus according to the present invention comprises: a cam unit comprising a cam driver, a cam slider to be driven by the cam driver, the cam slider having a punch retainer on its vertical side, and a cam base holding the cam slider; and a fallen L-shaped module base bearing the cam unit, and being adapted to be laid and fastened to the lower die holder, the fallen L-shaped module base having a button die on its vertical leg in confronting

relation with the punch retainer of the cam slider.

Also, a method of adjustably fixing a punch and a button die to a press machine in exact alignment according to the present invention comprises steps of: preparing a module cam assembly as described above; fastening the punch to the punch retainer of the cam slider and the button die of the upright leg of the fallen L-shaped module base to be aligned with each other in confronting relation; and putting and fastening the module cam assembly having the punch and button die fixed in position on the lower die holder of the press machine.

In setting, for example, a punch and a die in the press machine, first, these tool pieces are fixed to the retainer of the cam slider and to the button die of the upright leg of the fallen L-shaped module base, and the module cam assembly is set on the lower holder of the press machine. Thus, the tedious and time-consuming work, which otherwise would be required in situ, is made unnecessary.

The cam unit can be moved back and forth on the horizontal leg of the fallen L-shaped module base, thereby adjusting the distance between the retainer of the cam slider and the button die of the upright leg of the fallen L-shaped module base in respect of the length of the punch.

Other objects and advantages of the present invention will be understood from the following description of module cam assemblies according to some preferred embodiments of the present invention, which are shown in accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

Fig.1 is a perspective view of a module cam assembly according to a first embodiment of the present invention;

Figs.2A, 2B, 2C and 2D are front, side, plan and bottom views of the module cam assembly of Fig.1;

Fig.3 is a perspective view of a module cam assembly according to a second embodiment;

Figs.4A, 4B, 4C and 4D are front, side, plan and bottom views of the module cam assembly of Fig.3;

Fig.5 is a front view partially in section of a module cam assembly according to a third embodiment;

Fig.6 is a front sectional view of the die installing conventional cam unit assembly;

Figs.7A and 7B are plan and front views f a conventional cam unit; and

Figs.8A and 8B are plan and front views of another conventional cam unit.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to Figs.1 and 2, a module cam assembly 1 according to the first embodiment of the present invention is of the horizontal type. It comprises a vertically movable cam driver 2, a horizontally movable cam slider 3 to be horizontally driven by the cam driver 2, a cam base 4 slidably holding the cam slider 3, and a fallen L-shaped module base 5 integrally connected to the cam base 4. These parts are arranged from top to down in the order named. The cam driver 2 has a downward slope, whereas the cam slider 3 has an upward slope. The cam driver 2 rides on the cam slider 3 with their slopes abutting on each other. A positive return 6 is provided between the cam slider 3 and the cam base 4. The cam driver 2, cam slider 3, positive return 6 and cam base 4 together make up a cam unit, which is the same as the conventional horizontal type of cam unit. No further description, therefore, is required.

The fallen L-shaped module base 5 is the essential part of the present invention, and it comprises a horizontal leg 5a and an upright leg 5b integrally connected to the end of the horizontal leg 5a. The upright leg 5b stands parallel to the vertical side 3a of the cam slider 3. The vertical side 3a has a retainer 26a fixed thereto. The upright leg 5b has a mounting area 5c in confronting relation with the retainer 26a of the cam slider 3.

Specifically the mounting area 5c has tapped holes to fasten a die 27 by screwing bolts. A punch 26 is firmly held by the retainer 26a on the cam slider 3. The upright leg 5b has a through hole 5e for removing the remains of work pieces after being punched (see Figs.1, 2C and 2D).

The die 27 is loosely bolted and tentatively fastened to the mounting area 5c of the upright leg 5b, and likewise, the retainer 26a is loosely bolted and tentatively fastened to the cam slider 3.

To center the punch 26 with respect to the die 27, the cam slider 3 is pushed forward against the resilient force of the positive return 6, and the punch 26 is inserted in the die 27, and then, the retainer 26a and die 27 are fastened to the

cam slider 3 and the upright leg 5b for example, by means of the instantaneous adhesive agent such as AronAlpha (trademark). Then, the cam slider 3 is allowed to return to its original position, and the punch 26 is pulled out of the die 27, and the screws are tightened to fasten the retainer 26a and the die 27 to the cam slider 3 and the upright leg 5b respectively.

Thus, the module cam assembly 1 has the punch 26 and the die 27 fastened exactly in alignment, and the module cam assembly 1 is brought and laid on the lower die holder 25 of the press machine in situ. Then, bolts are inserted in the holes 5d of the module base 5 to be driven into the tapped holes of the lower die holder 25 of the press machine.

Thus, the centering can be attained without the tedious adjustment; slowly and by degrees raising and lowering the upper die holder 21 between its upper and lower dead points to move the module cam assembly 1 back and forth, and hence the punch close or apart from the die. Elimination of the tedious, time-consuming alignment effectively reduces the working efficiency.

Referring to Figs.3 and 4, a module cam assembly 7 according to the second embodiment is of the flying (aerial) type. It comprises a cam base 8, a cam slider 9, a cam driver 10, and an L-shaped module base 11 arranged from top to bottom in the order named. A positive return 12 is provided between the cam base 8 and the cam slider 9. The L-shaped module base 11 comprises a horizontal leg 11a and an upright leg 11b integrally connected to the end of the horizontal leg 11a. The upright leg 11b has a mounting surface area 11c parallel to the confronting side 9a of the cam slider 9, on which fixed is a retainer 26a having a punch 26 held at its center. The die 27 is fixed to the mounting surface area 11c of the upright leg 11b. The punch 26 can be centered relative to the die 27 in the same way as in the first embodiment.

Fig.5 shows a module cam assembly 7a according to the third embodiment. A cam base 8, a cam slider 9, and a cam driver 10 together make up a cam unit (shaded in the drawing) can be moved on a fallen L-shaped module base 11 so that its horizontal position may be adjusted. This arrangement permits selective use of punches 26 whose length may vary, for example, from 70 to 100 millimeters.

For this purpose the fallen L-shaped module base 11 may have a series of mounting holes made at intervals on its horizontal leg 11a for bolting the cam unit assembly 7a at a controlled position. Otherwise, the cam driver 10 is designed to

be slidable on the fallen L-shaped module base 11, permitting the continuous positional adjustment in respect of the length of the used punch. The horizontal type of module cam assembly 1 according to the first embodiment may be designed to permit the continuous positional adjustment of the cam unit in respect of the length of the used punch.

The die 27 can be adjusted vertically in position by using a shim 13, thereby compensating for the vertical change caused by the length of the used punch. Likewise, the die 27 can be adjusted horizontally in position by using another shim 14.

As may be understood from the above, the centering can be easily performed in the module cam assembly, and the module cam assembly having its tool parts aligned in position is brought to, laid on and fastened to the lower die holder of the press machine in situ. Thus, the tedious, time-consuming work is not required for centering in situ. This contributes to improvement of the working efficiency.